Museum Multiplicities

Field Actions and Research by Design

edited by Luca Basso Peressut, Cristina F. Colombo
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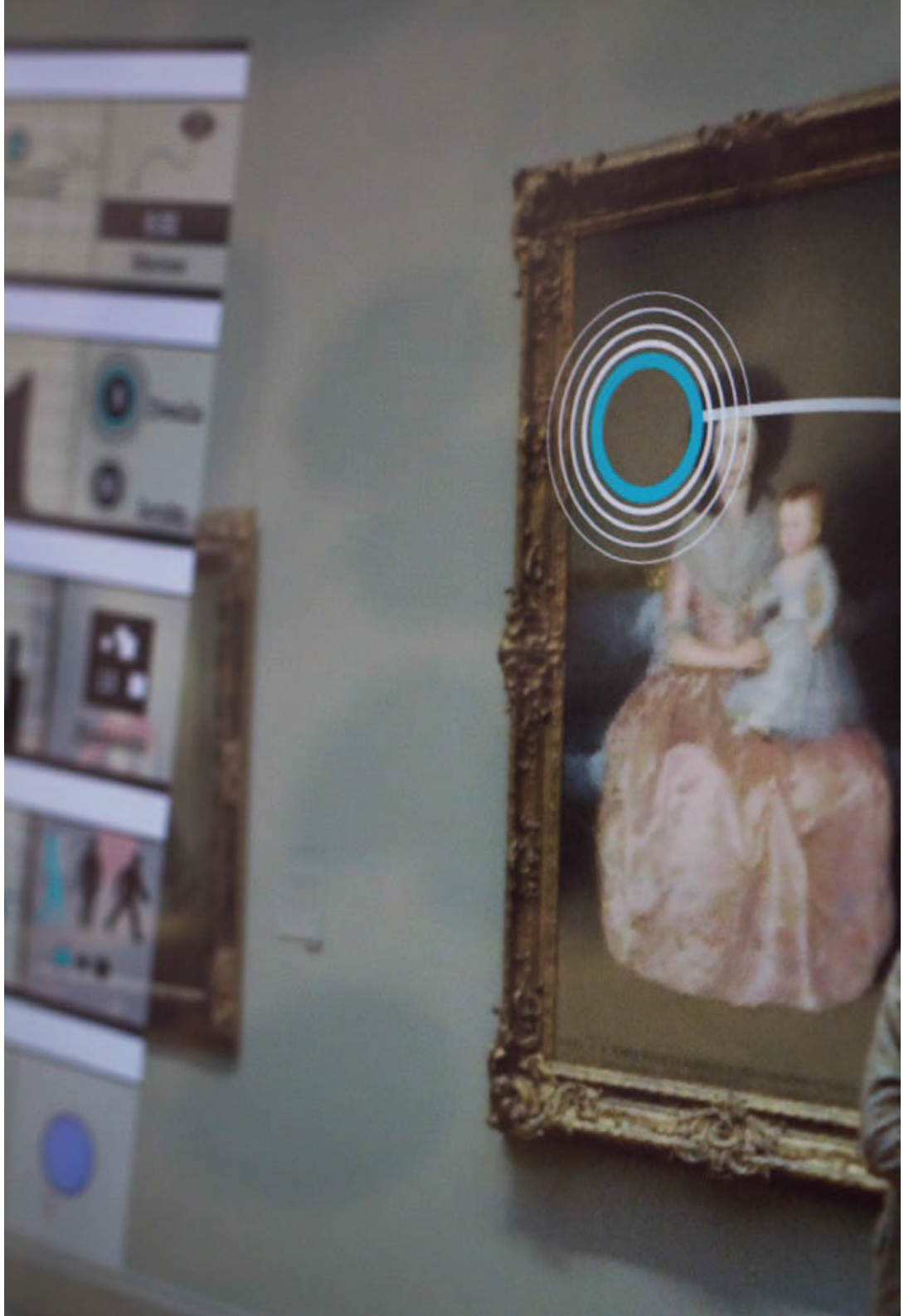


Seeing Yourself in the Museum

Experimental Actions and Methodological Potentials for Walk-through Studies in Exhibition Contexts

→ JAMIE ALLEN, JAKOB BAK, CHRISTOPHER WHITEHEAD, DAVID GAUTHIER

> Yet this seeing which comes before words, and can never be quite covered by them, is not a question of mechanically reacting to stimuli… We only see what we look at. To look is an act of choice. As a result of this act, what we see is brought within our reach—though not necessarily within arm's reach... We never look at just one thing; we are always looking at the relation between things and ourselves. Our vision is continually active, continually moving, continually holding things in a circle around itself, constituting what is present to us as we are.
> (Berger 1972)

→ INTRODUCTION

The museum space is a site rich in potentials for investigating the interrelation of individual, subjective perspective and objects within a designed environment. In the museum, cultural objects and dynamic information are staged as experiences, and for interpretation, in a relatively curated and constrained fashioned. Combined with visitor expectation, movement through a museum space is a usefully restricted laboratory of human experience, allowing an occasion for the deeper examination of relationships between people and things in environments and contexts. The culture of museum design puts increasingly more emphasis on

PREVIOUS PAGE, IMG. 1.63 — *Museum of Copenhagen, Copenhagen, Denmark. Detail of the schema for the treatment of qualitative data arising from recorded "walkthrough" video. Courtesy Copenhagen Institute of Interaction Design (CIID). Photo by Catherine Descure.*

self-selected pathways and open planning, involving a re-examination of prior assumptions of how museum itineraries can and should be sequenced. This shift, along with desires to refrain from the extrinsic "tracking" of museum visitors in order to evolve an understanding of how visitors compose, or recompose the space of an exhibition, creates the need for expanded reflexive tools for user studies.

Our intended direction towards the use (or misuse) of technologies-of-capture is to invert the perspective of an "omniscient" and "omnipresent" observer to a single viewport of the subject engaged into a locomotive-scopic experience of the museum. On one hand, the use of time-based video recording provides us with a representation of the "locomotive-scopic" ordering of experience—a representation of spatial, chronological, visual and audible accounts of movement and encounters through space. On the other hand, the digital material produced by such recording is used as building blocks in the re-sequencing of events according to a given narrative construct. Through the subject's interaction with the recording of his/her recent experience it is held that his/her reflexive process is assisted towards the building of a narrative orientation towards *making sense* of an experience.

The technological intercedes in our archival and immediate awareness and knowledge of ourselves. Media are interruptions "of all feedback loops between a body and its doubles," (Kittler 2010, 181) revealing behaviours physiological and otherwise, through the deteritorialisation of perspectives. The recording of images, and apparatus of the camera, imply the oscillation between the composition of an objective historical, visual archive, and the immediate represented or suggested body of the photographer or photographed. The contemporary proliferation of technical imagery has done much to foreground and decompose more unified versions of history, subject-object relations, and nationalist narratives. In this we witness an inversion of much of the 20th century histories of photography, or photographic histories: where nationalism was used to concretise and cultivate singular narrativities and national iconography. In Michel Foucault's time, history "transforms documents into monuments," our sense of contemporary transforms monuments, first into documents and then again into the first-person *moments*—on the personal "stream" of a Facebook feed or Tumblr Blog (Foucault [1972] 2012).

Moving image recording devices have recently reached a scale small enough to be mounted on the body, inverting many aspects, affects and cultural metaphors of photography and moving images. From the use of phonographs and daguerreotypes, to film, video, and today's higher resolution digital audio-visual recording systems, researchers in ethnography and anthropology have employed advanced technologies to capture experiences inside and outside the museum. As such, the work presented forms part of a tradition of technological archiving of the body in locomotion; an addendum to Eadweard Muybridge's chronophotographies, from the inside-out. Combined with a computer scientist's view of the potential of algorithmic treatment of images, we furnish a further

example of what Mark B. N. Hansen has called the postphotographic agenda, with its "deterritorialization of reference." Also imperative is the highlighting of the technical image, regardless of its perspective, within a "'generalized and extended condition of visuality'—machinic vision—in which the task of processing information, that is, perception, necessarily passes through a machinic circuit." (Hansen 2001, 60)

Using technology to capture experiences in museums is a field of rich study within Human Computer Interaction discourse and research. The project described herein relates to and has been inspired by a number of seminal works that deal with auto-biographical and auto-ethnographical tools for a variety of purposes. SenseCam (Hodges, Berry, and Wood 2011) is a wearable photographic device with sensors enable researchers to capture events from daily life with regular intervals and triggered by special occasions. Special software let the user review the pictures to aid (autobiographical) recollection of past events (Doherty, Moulin, and Smeaton 2011). StartleCam (Healey and Picard 1998) uses a similar approach but is triggered by measurements of a physiological reaction (skin-conductivity) to experiences, and thereby intend to capture moments that induce an elevated (physiological) response (startle).

The advent of the above technologies spurred research into a more general "quantified-self" related area known as "life-logging" (Bell and Gemmell 2010). The idea is to employ technologies to capture events and combine these with computer-accessible data from contextual sensor and other interactions with digital communications systems, such as email, calendar items, documents, etc.) to create a "lifetime-store" to facilitate recollection and personal information retrieval (Gemmell et al. 2002). Abigail J. Sellen and Steve Whittaker voiced a critique of fundamental assumptions in this approach to "life-logging" and proposed a set of design guidelines for system developers, including seeing lifelogging "store-items" not as memories in themselves, but rather cues to trigger recollection of memories—a view shared and expanded upon by our museum walkthrough work (Sellen and Whittaker 2010).

What has become known to the authors as "walkthrough" research, is a first-person perspective video recording by museum visitors, with subsequent video data analysis, using a head-mounted cameras. We point to the possibilities and values in this work through examples in the museum space, as potentials for the study of behaviour, physical movement, meanings and memories. The set of methodological potentials outlined here result from fieldwork conducted between the Copenhagen Institute of Interaction Design and the International Centre for Cultural and Heritage Studies (Newcastle University), at a number of partner museums in Europe. Researchers have devised experimental actions through fieldwork using head-mounted cameras, interview protocols, and digital image processing. The work bridges new work in digital ethnography and qualitative display analyses insights. A main focus of the research is on the reflexive experience of museum goers, that is, what it is that paying witness to a document of one's own experience in the museum can bring

to the discussion of a visitor's identity and behaviour. Further, the work provides an opening to expanded work studying ambulatory experience and its effects on identity, as a critical companion direction for pursuits in urban planning, architecture and spatial design more broadly.

The focus of our walkthrough research is not the recollection of events from a more distant past, but reflection on rather recent experiences using the mediating nature of the tools employed to see those experiences in new perspectives, helping to construct new understanding through evolving reflexive interviews and discussion. The work of Lisa Gjedde and Bruno Ingemann has been an inspirational analogue for our work with using head-mounted recording devices in exhibition spaces and combining it with interviewing techniques (Gjedde and Ingemann 2008). Using relatively simple video and video analysis technologies, mounted on the head or body, it is possible to give an impression of visitor experience that is bottom-up, but is derived more directly from individual perspectives of people. This is an inversion of the more common modes of digital user-study methodologies, which usually employ a top-down structure of either visual (closed-circuit television cameras, detecting "visitor flow") or informational omnipresence (Wi-Fi tracking to monitor presence in rooms).

The intention is to allow for a reflection on experience and memory, and avoid deterministic characterisation of exact movements or visitor intention. These deterministic tendencies are unfortunately more common than they should be in user-studies and design probes involving information technologies. Beginning with an understanding of the ambiguity which always lies between quantitative and qualitative information, our investigations are tailored to avoid the assumption of more definitive characterisation that we project on technological capture of any event or process. Instead, the question we set for ourselves becomes one of developing profiles, traces or imprints which serve as a reflexive point of departure for both researchers and visitors alike.

→ EXPERIMENTAL ACTIONS IN THE MUSEUM SPACE

Museums can be thought of as "places for defining who people are (...) how they should act [and] places for challenging those definitions" (Karp et al. 1992, 4) Museums remain powerful didactic spaces, as well as self-reflective, self-composed and increasingly dialogic experiences, shaping identity and relations to meaning. This, while their design and physical fixity keeps them from being wholly penetrable and recomposable. This tension—between the composed space of the museum and the improvised path of the visitor—is as old as museums themselves, if not as old as the built and structured environments of cities and architecture. There is no resolving these tensions, but there may be better ways of representing and characterising them for visitor, museum studies researchers and museum designers.

One way of understanding museum space that informed thinking about this research is the notion of the museum as map (Whitehead 2009; 2012). In this view, museum displays are spatial representations of knowledge that are intrinsically capable of charting relations between things. This capability is a result of technological operations such as the spacing, ordering and juxtaposition of objects, or how they are labelled and "scaled" through techniques such as positioning or lighting, in such a way as to create what Wolfgang Iser called "response-inviting structures" (Iser 1980). In this sense the museum acts as a form of cultural cartography. However, the ontology of the museum means that this is a form of cartography that is also intrinsically capable of organising narratives, for example, about the history of art, or about the history of migration into a region. This is because of the spatio-temporal ordering of the visit—the set-up of a temporal logic of staged encounters with objects and information for an imagined visitor moving within architectural and designed space. In this sense, curating can be understood as a kind of mapping, leading to the production of a map that is intended for others. (In many cases it can be said that many "maps" are produced: a number of cartographies often exist in one space as a result of the layering of curatorial efforts both synchronically and diachronically, leading to representational ambiguities and complexities). Visiting, it follows, is an engagement with a "map" or set of maps. This is at once and necessarily a personal process of cognitive and affective remapping that is made iterative through memory processes ("remembering," "recollection").

This research allows us to make some sense of visitor engagements with the cultural cartography of the museum, which may not involve the kind of seamless transfer of information associated with "effective" reading of the "useful" map. More frequently, we find that visitors' experiential remappings are based on dispositions, affective responses and references to personal histories that are unpredictable and unknowable from the curatorial viewpoint; for example: the way in which a museum object may trigger a personal childhood memory; how a fleeting reference in a display to a person once known by a visitor can come to dominate the experience and memory of the visit; or even how a visitor's vegetarianism leads to purposeful non-engagement with a particular artwork. One thing that this research can offer is a view of the potential for difference or cleavage between the museum display as map and visitors' own remappings, where the "contents" of the map, their scaling, or position within narratives can appear quite different. Our qualitative data collection, as well as our development of specific metrics based on assumptions (e.g. that dwell time is an indicator of directed attention to an object), can be seen as experimental means of "tracing" of visitors experiential remappings that is itself an ulterior cartographic action.

Key to the experimental actions described here is the notion of reflexivity, of two types. The first is of the museum visitor on the museum space, providing tools and methods to allow them to recognise that the material is not just there; that it is staged, and how (Clarkin-Phillips). Secondly, we seek to express self-reflexivity of the museum visitor, their own accounts of personal experience, narratives, references, and memories. These reflexivities are precipitated through a set of post-walkthrough

voice-interviews, where the visitors are asked to constructively review and discuss their own experiences. What results is at once visitor-exhibition documentation, and a reflexive evaluation of the museum experience. Digital head-mounted video recording technologies present a means for the reflection of experience back on itself, attempts at avoiding the problems or claims of such capture totalising experience.

Conducting quantitative and qualitative ethnographic research in the museum context constitutes attempts at understanding how cultural objects (physical or otherwise) are interpreted and reflected by subjects moving through these sites. The designed environments presented to museum visitors are in constant interaction with kinesthetic, somatosensory and affective aspects. Complicated through the addition of dynamic and interactive objects, and the dynamics of subjective interpretation and identity, the potential for the inventive use of technologies of digital media capture seems great.

There are a panoply of methods that attempt to capture and analyse the experience of people in museums. The majority of these are not empirically tested, and fall into either intersubjective techniques (surveys, interviews, focus groups) or into analytical-topological methods which aim at numeric accounts of visitor numbers, exhibitions, tickets sales and satisfaction-survey results. As museums have long been presumed as sites of pedagogy, many studies are geared towards the evaluation of informal learning. Shifts in the mandate, focus and design of 21st century museums points to increasing focus on institutional-personal relationships, as the museum is called increasingly to deal with issues germane to the communities in which they are situated. These shifts reveal the inadequacy of (both intersubjective-qualitative and analytical-quantitative type) methods to evaluate newer models of complex exhibition and engagement in the museum (Borun 1977).

The experience of the museum space is, generally speaking, an ambulatory one—that is, framed by the motion and location of bodies, at the pace of walking. The activity, although formalised by the overall circumstance implied by visitor and institution (e.g. "Natural History Museum," "Museum of Modern Art," etc.) constitutes an encounter that is deliberate and delicate balance between visitors' personal intents and goals and the constraints imposed by the museum space. Increasingly, museum design communities are shifting their attention to exhibitions which allow for open paths, visitor-selectable journeys and serendipitous moments of discovery. These motivations towards purported "democratisation" of the visitor itineraries lies in tension with the historically and architecturally firmaments of the modernist, and pre-modern museum. Most such buildings are designed to "look best" on floor plans and diagrammatics, symmetrically arranged for aerial, horizontal cross-sectional views as if to emphasise beyond doubt the cartographic function. It is the context of these spaces that has helped evolve useful critiques of the possibility of curatorial or designerly objectivity of this "gods eye view."

Bringing the perspective of museum visitors into play is difficult, not only for reasons of tradition and custom in museum study practices, but because of how this modernist tradition informs documents used to create, manage and build these institutions' structures. Design, planning and study of museum or exhibitions gives obvious preference and importance to all kinds of "top-down" planning documents: there are architectural rhythms and harmonies that can go largely unnoticed by the museum goer; experiential and spatial schema may leave visitors unwitting, unaware or even confused as the scale of the map they inhabit is not their own. Within the ecosystem of physical structures, practices and design documents, it becomes of concern how we might render present more vivid first-person accounts of visitor experience through digital media. What are the bottom up, ground-level, "walkthrough" views of the museum, and how could these be considered on-par with the constellation of plans, materials, reflections and accounts within museum design, museum and (national) identity research, architectural and design practice, and studies of visitor experience and learning? How might we use readily available and future-facing multimedia techniques to investigate the experience of museum and exhibition goers, in a reflexive and insight-driving way? And what can we learn from these techniques regarding the composition of space, experience, memory and identity in a museum space?

We can use data-rich multimedia documents, such as digital video derived from recorded museum visitor itineraries, as quantitative and qualitative reflection for the discursive analysis of museum experiences. Digital video allows for the creation of documents which are interestingly, and inherently, somewhat quantitative and qualitative in the same moment. The temporal, representational form of video always re-composes a narrative, or re-performs experience to some degree. These aspects of digital video within ethnographic practice are open to various hermeneutics and depict, illustrate and spur further analysis. The discourse and history of the use of ethnographic video shows it to be subject to interpretation much in the same ways that textual and linguistic descriptions are, and so helpfully an immutably qualitative in nature (Pink 2009). All this, while the random access, indexed and data-based character of digital video gives us a numerical and quantified sample set of a visual field, which can be algorithmically treated by computers and image processing software. Here we have the decidedly "quantitative" aspect of digital video, markedly new in terms of its integration within traditional ethnographic practices within humanities research fields. With relatively simple image processing techniques we can create a set of useful metrics from head-mounted camera video, which augment the reflexive power of the video document created. They include devised metrics such as "eye miles" which give a relative measure of the amount of eye-movement the visitor undertook during a museum visit. Also algorithmically determinable are more familiar museum user studies metrics such as "dwell time" and "number of dwells," which give a time-measure of and numeric count, respectively, of the moments during a museum visit where a visitor *appears* to pay prolonged attention to an element, object or display.

IMG. 1.64 — *Museum of Copenhagen, Copenhagen, Denmark. The walkthrough experiment: a museum visitor wearing the head mounted camera.Courtesy Copenhagen Institute of Interaction Design (CIID). Photo by Jakob Bak.*

Of course, mediating between the representative impulse of video-as-narrative and the more intrinsic, data-derived analyses in a way that helps researchers and visitors, theorists and practitioners derive their own understandings, presents a significant challenge. A subsequent question becomes, how do we fuse this dual character of audiovisual documents such as digital video? The aesthetics and diagrammatics of presentation and summary documents need to show the dual, quantitative and qualitative, character of these tools at once, and in appropriate ways. The "walkthrough" should result in multimedia, and more statically publishable documents, that create visual overlays for these complementary types of data streams. As pointed to in forgoing discussions of creating documents that inform the practice of museum design as well as museum studies research, our investigations are from the outset invested in the idea of creating boundary documents for the translation of individual experience in a museum to multiple stakeholders and disciplines. This type of work is an example of practice-based Interaction Design Research, a sophisticated melding of complex *types* of data as conjoined precis, for further discussion and divulgence.

→ REMEMBERING AND REFLECTING

The museum *itinerary* refers to a route which is perambulatory, that is, it requires visitor locomotion through museum space. At the same time, narratives and subjectivities are created between people and objects, people and other people, people and meaning structures, individuals and the institution (to name just a few). Each itinerary is an composed remapping, a tracing of understanding that comes about through the dynamic interaction between the structuring physical space of the museum (Whitehead 2009, after Bourdieu) and visitor dispositions, needs and choices, and that manifests as a specific, ordered encounter with cultural objects. Rather than conceive a given exhibition or museum space

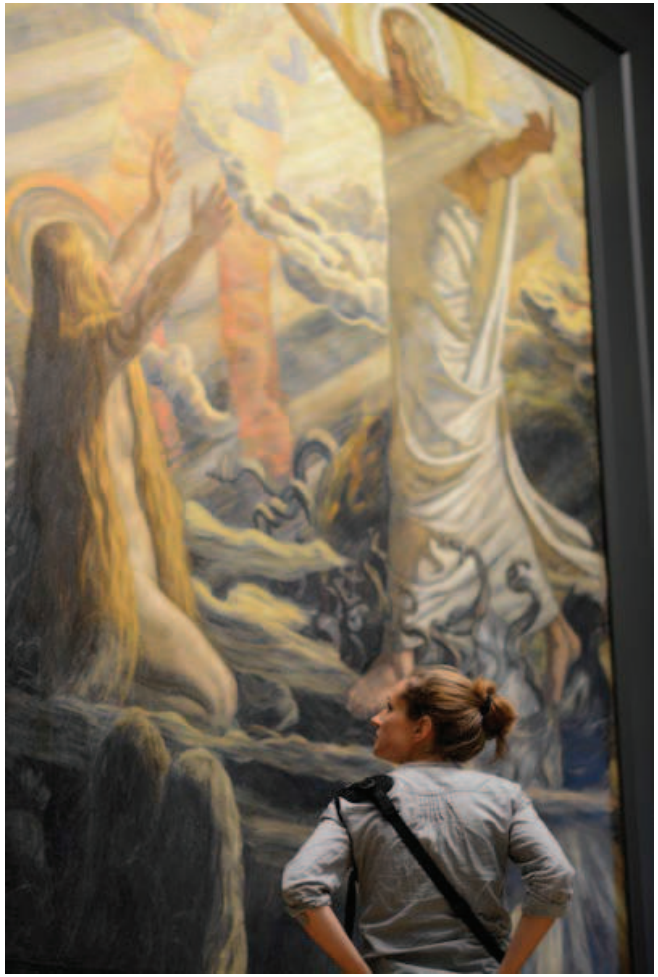
as single, totalised whole, representing a single event or forming only one cartography (which in any case it rarely, if ever, is, because of the complexities of cultural production), the notion of an itinerary serves to account the dynamic relationship between things, meanings and people as constructed by visitors engaged in coordinated acts of locomotion, sensing, reading and viewing. Museum visitors do not experience "the museum," they experience a set of subjective affinities drawn between cultural objects and other encounters, rather than dictated and organised according to the planning or curation of the museum.

This complex relational experience cannot be rationalised or determined completely, although there is much we can know about routes and dwell times, levels of enjoyment and information retained through classical user study methods. To research the subtleties of an individuals' experience in the museum, however, is to research his or her memory of that experience. Museums are the site of an encounter between cultural memory and personal memory, where material and medial dispositifs are presented which reflect and challenge tastes, values and selfhood. What post-visit user studies often lack is such a reflective dispositif for the remembering and reconstitution of museum itineraries, by and for visitors.

In ethnographic practices there is always a gap between "what we do" and "what we think we do." These gaps, far from being foreclosable, are interestingly disjunctive, a productive aperture for allowing people further insight and understanding of how the museum space effects and affects them. The walkthrough is a processual link, attaching the "map," as general, concrete, top-down and stationary, to the "itinerary" as idiosyncratic, dynamic, bottom-up and recomposed. The modes of remembrance are here referred to those suggested by Giorgio Agamben's in his contrasting modes of historic remembering at Auschwitz: "One is the history that comes in the flesh, that is somehow embodied, as the figure of the witness; and the other is the history that has a tendency to become property or something that is petrified in, for instance, the form of an archive or a collection of documents." (Szymczyk 2014)[1]

Head-mounted video self-analysis provided for by walkthrough research gives support for personal recall, where the "living memory" of the walkthrough is enlivened as a distributed set of mediated activities, the threads of which may be recalled, discussed while associated contents are presented again. The relatively immediate memories whose recall we are concerned with enabling are for the most part highly informal, and make no claims or auspices toward objectivity. They are mainly related to an individual's voluntary interests and pursuits in the museum, and lie outside of functionalist or didactic goal orientations. As such, decision making is reflected upon in a holistic and subconscious manner, eliciting responses along the lines of "I'm not sure why I went that way… maybe it was because…" or "I didn't realise I stood in front of that painting for so long," instead of more rational or specific descriptions of tasks or intention.

1 See Ibraaz: Contemporary Visual Culture in North Africa and the Middle East. 2014. "Adam Szymczyk in conversation with Omar Kholeif." Accessed March 15. http://www.ibraaz.org/channel/7#author106.



IMG. 1.65 — *Museum of Copenhagen, Copenhagen, Denmark. Studying the museum from the user's perspective. Courtesy Copenhagen Institute of Interaction Design (CIID). Photo by Dionísio Soares Paiva.*

This approach proceeds via a set of narrative orientations informed by theoretical work of Jerome S. Bruner and Mieke Bal (Bruner 1990; Bal 2009). In contrast to our observations of current literature on autobiographical and mnemonic technologies (Charness, Best, and Souders 2012) rather than conceiving experience as a deposit of events, from which an autobiographical capturing system is accounting for, we take a constructivist perspective of experience and memory where it is conceived as mediated through reflexive thoughts constructing stories of past events (whether factual or imaginary). Hence the focus of our design is to develop methods and technologies which focus on the production of (abstract) narratives; a sequential ordering of events, mental states, and encounters

involving museum visitors (subjects) as characters. Our aim is to provide technologies and methods for a subject to construct their own narrative. Of key importance here is the notion that events can be in logical and/or chronological order which may not be indexed to a linear notion of time, that is not necessarily bound to the captured media time (here video sequence), nor has it to be indexed to the linear notion of space (here the museum's floor plans). Narratives can function in relation to, in ignorance of, or simply against these two linear notions. In this sense, a thematic "cartography" or "schema" supported by our technologies and methods can support narrative construction where sites of meaning embodied into museum's cultural objects (physical or otherwise) can be or pulled into conceptual and diagrammatic territories and in turn account for their "lived" genesis, morphology and stated context.

The experimental actions we have devised are methods and techniques for addressing modes of *reflexivity* (as contrasted with recollection for example) on past events and cultural encounters which took place in the museum. This aspect is of prime importance as the focus and value is less about recall than it is about self-identity, meaning-making and knowledge. In this sense, abstract, suggestive and constructive methods are employed in order to represent and manipulate captured and mediated observations of museum experiences.

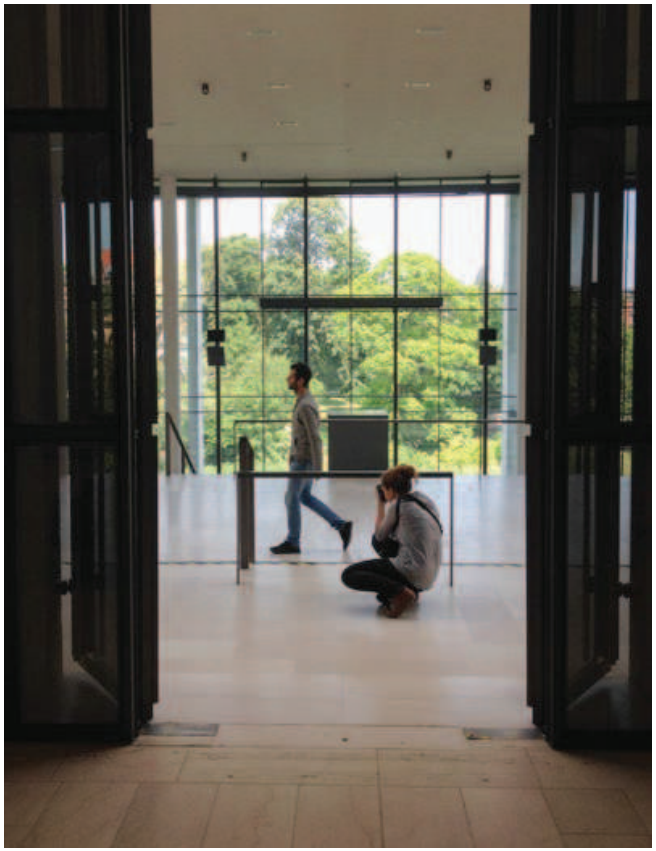
→ WALKTHROUGHS: AN EXPERIMENTAL METHOD

The methodological experiments we have developed consist of an experience capture phase followed by a subsequent interview-guided reflection, partly facilitated by the previous capture. A museum visitor (and in a few recent experiments, visiting couples), are asked to make a short walkthrough of a selected part of an exhibition wearing a pair of glasses embedded with a high definition camera. The equipment captures audio from the surrounding environment and video in the directions the visitor's head is facing during the walkthrough. This gives a near first-person perspective recording of the visitor's audio-visual experience of the exhibition elements and their route between them.

After the visit to the exhibition, the visitor is asked to sit with a researcher running the study, where two immediately following interviews take place. The first is a normal semi-structured interview (the Normal Interview) where the visitor is asked to recall his/her experience of the exhibition, the researcher guiding the conversation towards the visitor's account of what caught their attention, what they thought and felt while in the exhibit, as well as their recollection of their itinerary. The conversation is recorded on video.

The second interview (the Video Interview) uses the video recording as a prompting tool to guide a subsequent semi-structured interview. Here the visitor and researcher watch the capture from the camera glasses together, allowing the first-person recording to elicit discussions of the visitor's itinerary choices, emotions, thoughts and environmental factors

IMG. 1.66 — *Museum of Copenhagen, Copenhagen, Denmark. Second part of the experiment: interview following the visit, based on the head-mounted footage. Courtesy Copenhagen Institute of Interaction Design (CIID). Photo by Catherine Descure.*



IMG. 1.67 — *Museum of Copenhagen, Copenhagen, Denmark. CIID researchers investigating museum visitors. Courtesy Copenhagen Institute of Interaction Design (CIID). Photo by Jakob Bak.*

as situations in the recorded material (dwelling at an object, quick movement, etc) prompt either visitor or researcher to question/elaborate on a given subject. This Video Interview is recorded as a screen capture of the playback of the original walkthrough recording, capturing the conversation prompted during playback and any pausing/fast forward/rewind.

The method prospectively outputs a set multimedia documents:

1. A first-person perspective audiovisual capture of the visitor's itinerary in the exhibition using a head-mounted camera, mounted in a set of eyeglasses;
2. A video recording of the Normal Interview;
3. A screen capture of the Video Interview, which is essentially the secondary recording of the first person video created in step 1, but with "commentary track" and capture of pauses and other transport activities;
4. An "algorithmically" augmented video image, with metadata composited above the original footage;
5. A summary document giving various visitor metrics and statistics from the video image (prepared offline, and including statistics such as "avergae dwell time," or average light temperature).

Observation

The first (observation) phase uses a small head-mounted audio-visual recording device to capture a near-first-person perspective of the itinerary a subject trace through a museum exhibition. The second (reflexive) phase consist of an interviewer interviewing the subject while the latter is actively engaged in watching, manipulating and re-ordering the recording of his recent itinerary.

Interview

The interviewer conducts a semistructured interview based on a set of preconceived topics of interest to the overall study, but lets the interviewee and himself be guided by the recorded material and the discussion that arise from watching it together. Discussion on the subject's thoughts, actions and motivations for tracing the exhibition as he does is encouraged, prompting the subject when he (in the recording) deviates from his route, dwells at certain exhibits, move a lot or fast, or when seem to lose focus or attention on the exhibited objects.

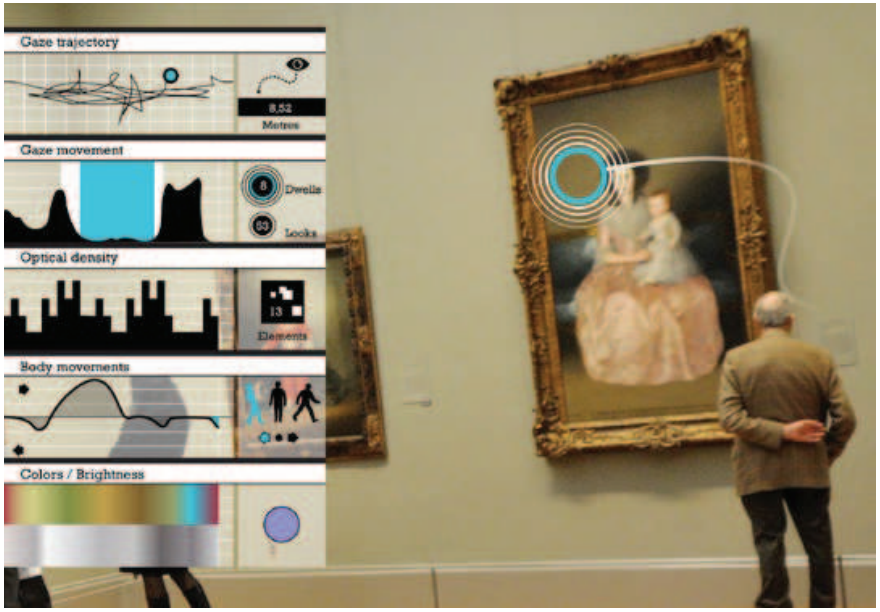
This interview, mediated by the recorded recent experience engages the subject in a reflexive sense-making activity which, through commentary of his or her own dynamic understanding of his experience, is recorded. Combining these materials to synchronise them provides a multimedia reflective document which relates to the techniques of more traditional qualitative analyses directed towards the topic of museums.

Digital Image Processing

Additionally, the video is processed by a set of simple video-processing algorithms that allow both summary data to be evoked from the video and audio streams (in the form of a static data visualisation), as well as real-time "metadata" to be displayed via graphical interface element on the stream after processing and re-rendering (in the form of a summary video). As example, the system is able to process and automatically catalogue the number of "dwell" times which occur during a museum visit. We are inspired in by methods and techniques employed in notable work in the field of "life-logging" (Whittaker et al. 2012), passive photography toward "reflexive technologies," or technologies that help unearth aspect of subjective experience and contexts.

Our video recordings present a single uninterrupted shot of the walkthrough (which can be up to an hour long, as an approximate average). In order to automatically segment and index video data into smaller fragments, forming the referential "building blocks" of the narrative, we extract dwells (movement pauses) and related motion transitions (movement) out of the recorded itinerary. Motion dwells are understood as moments where subjects engage with cultural objects and/or social encounters and can be extracted from video feeds using motion analysis. (The other metrics derive are shown in Figure 1, Figure 2 and Figure 3, which also shows three versions of the interface design for the combination of these analytics and the original video footage.)

The software created for the walkthrough work, in its current version, tracks movement of the edges of objects in a given frame ("optical flow") to determine the motion of the camera's point of view, and by doing so, inferring the movement of a person's head (wearing the head-mounted camera). The system is based on using lateral optical flow readings to distinguish and filter head movements, implying changes in the visitor's central field of view and are tightly associated to eye movement. These movements are those of horizontal (Yaw) and vertical rotation (Pitch) of the head around the neck, which filter out longitudinal movements of the body and head tilt (Roll), which don't imply change in the object of focus. With this motion in mind, a two-axis vector is generated that represents the head movements that affect gaze direction, the yaw and pitch dimensions. Some sense of the observation state of the visitor is then suggested by the "stability" of this vector. The proportion of "stable" frames over an average amount of head movement, thus normalising for "fast moves" and "fast moving visitors." Similarly, gaze "distance" (or the amount of distance the eye travels over the visit to the museum) and trajectory are computed from the same vector, together with an estimation of the path of the eye, globally (yaw and pitch movements). Body motion is inferred by taking into account the difference between the optical flow of the right and the left side and of the frame: if the left and right handside of the screen are moving in the same direction, the head alone is likely moving; if the left and righthand side of the screen are moving in opposing directions, the visitor's body is likely to be moving through space. Strafing



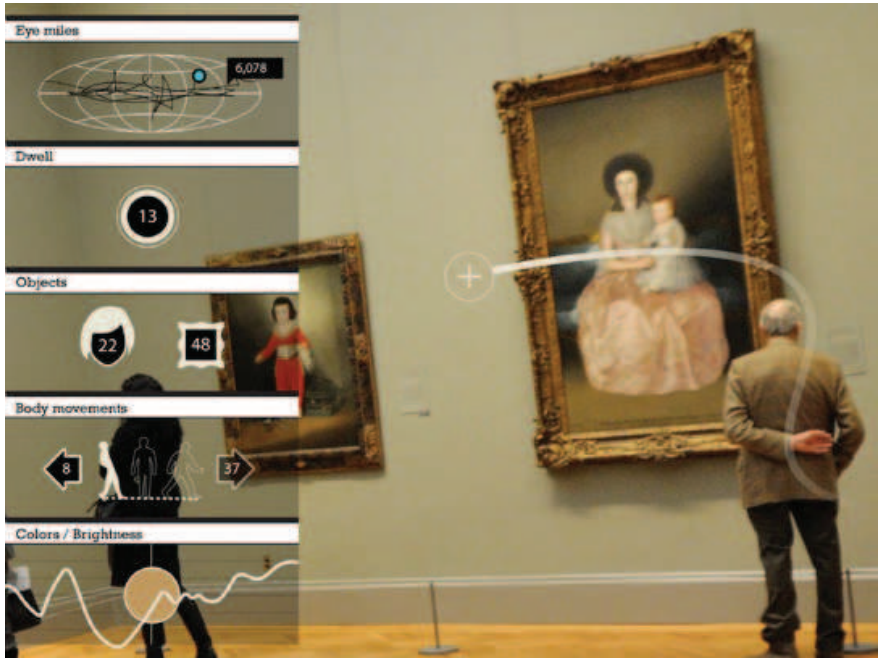
IMG. 1.68 — *The image includes a schema for the treatment of qualitative data arising from recorded "walkthrough" video. The upper left hand corner of the illustrative display indicating the "eye miles" of optical space traversed through the walkthrough, followed down the left column by a number and type of dwells, followed by a measure of the number of objects and/or faces in the immediate scene, a measure of forward and aft body movements, and relative measures of colour and brightness. Courtesy Copenhagen Institute of Interaction Design (CIID). Photo by Catherine Descure.*

(moving the entire body in a sidelong-direction, as in video gaming, was not found to be a common mode of movement amongst the walkthrough videos we collected).

A further metric, the "average colour" of the scene is calculated by averaging the signal of each of the RGB channels across the frame (normalised for luminosity). Similarly the scene luminosity is calculated by averaging all the RGB values across the frame. Finally, "optical density" is a relative measurement of the number of contiguous areas in the current frame, measured via standard object-bounding algorithms.

Digital Document Preparation and Rendering

These digital production elements, provide design-research outputs and investigations into the communicative forms that such work should and could take. Informing more traditional documents of museum planning and study is a particular goal. How might we assure the inclusion of the outputs and insights derived from our walkthrough methods enter the ecosystem of data, graphics and texts used to understand and plan museum experiences? The computer science of image processing, applied to digital ethnographic approaches, produces rich observations and representations of complex subject-object experiences as they unfold in-situ. The development of the methodology described herein is a truly interdisciplinary endeavour, augmenting the user-study of museums as a combined qualitative and quantitative study, where focus is directed towards enabling reflexive interpretations of museum experiences.



IMG. 1.69 — *Schema for the treatment of qualitative data arising from recorded "walkthrough" video. Alternative view. Courtesy Copenhagen Institute of Interaction Design (CIID). Photo by Catherine Descure.*

→ DIGITAL DOCUMENTS OF MUSEUM SPACES

The raw video which results from the experimental processes outlined above shows promise for digital ethnography methods development as the recorded elements serve as a prompt for further discussion, not as an attempt at total description of the event. The study of display and exhibition design derives early insight from the process in areas related to how memory, knowledge and identity of the museum visitor is composed by a walk through the space (in contrast to what a designer, architect or curator might have supposed or intended this composition to take place). Exposed through the digital video document are the rhythms, juxtapositions, frustrations and individual pathways allowed for by an exhibition and its artefacts, in individual and a potentially in aggregate (as a topology or average of multiple visitors). Highlighted and, to some degree, captured through the self-reflexive narrative are those "things we do, but don't know we do," in the controlled environment of the museum. One example of these sorts of insights includes the "micro-investigations" which people undertake when in a museum space, composing their itinerary to fulfil an ad-hoc informational, experiential goal, such as finding all mentions and representations of women in a display, or the oldest artefact in the room. This activity may be prompted by moments of confusion or frustration, for example where a visitor reads in a text panel that the theme of a display is women, but this is not immediately obvious to him/her from a first look at the objects and labels on display. Alternatively, it may be prompted by curiosity or the feeling that particular displays can respond to one's personal history and interests.

The graphical interface shown (with alternates) in the figures give good indication of our aforementioned intent to presentation summary documents with dynamic appeal, which show multiple kinds of information in appropriate ways. These images are dynamic animations on the video document of the walkthrough and have been designed not only to present requisite data of interest, but to do so in a way that is intelligible and culturally acceptable to museum researchers and everyday museum visitors. Colour schemes and line styles reference the language of planning and schematics, while the summary elements of "objects" and "faces" allow for quick and simple reflection on what is being communicated, without expert knowledge. At the same time, the function of the algorithmic results represented are specifically chosen to be easily understandable, and not "high level" computer vision metrics.

→ CONCLUSION

The purpose of these experimental actions is to provoke insight into the development of more reflexive and critical methods for museums studies, as well as the understanding the design of spaces as relational and individually composed. Future publications and methods development are intended to expand on these initial investigations, toward a developed protocol for field investigations, standards for coding, and image and audio processing techniques, as well as output format that fit the processes and practices of museum researchers and practitioners alike. The potentials for the technique as a user-perspective-driven account of the composition of both meaning and identity in the museum space have excited much interest in the area for further deployment in museums and exhibitions, as well as other areas of investigations where walking and the memory of experience meets the assumptions and proscriptions of designed public environments.

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